

## PATENT ABSTRACTS OF JAPAN

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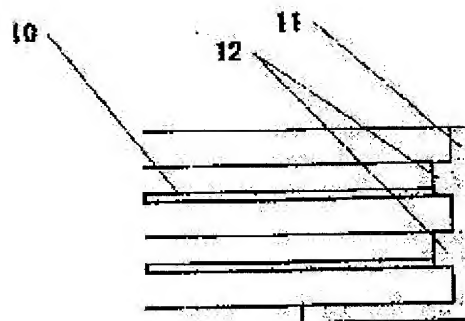
(72)Inventor : TAKASE KOHEI

## (54) TERMINAL ELECTRODE OF LAMINATE ELECTRONIC COMPONENT

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To improve characteristics in a high frequency range above GHz by omitting a side polishing process after cutting required in a conventional manufacturing process for a laminated electronic component, providing a terminal electrode which hardly has a wire break, and reducing the residual inductance of the terminal electrode.

**SOLUTION:** The laminated electronic component formed by laminating and sintering insulating green sheets integrally has a terminal electrode formed by arranging a layer having a recessed part stepped back from other layers at the side of a green sheet abutting against an internal layer electrode connected to a terminal electrode on the side. As for via holes connecting the internal layer wiring electrode to a plane terminal, the via diameter of at least  $\geq 1$  layer is made larger than that of any other internal layer in upper and lower layers where the plane terminal electrode is formed.



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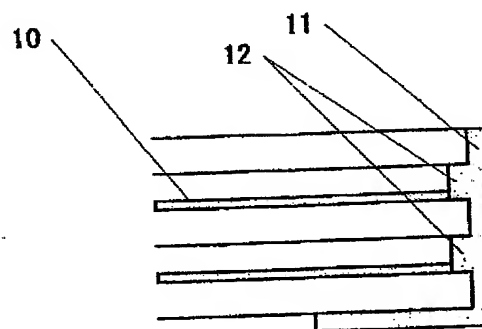
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5E346 AA43 BB16 CC16 CC18 EE21  
EE29 HH06 HH11

(54)【発明の名称】 積層電子部品の端子電極

(57)【要約】

【課題】 従来の積層電子部品の製造工程における切断後の側面研磨工程を省き、かつ断線が発生し難い端子電極を提供し、さらに端子電極の残留インダクタンスを減少させてGHz以上の高周波帯での特性を改善する。

【解決手段】 絶縁性グリーンシートを積層し一体焼成してなる積層電子部品において、側面の端子電極に接続される内層電極に当接するグリーンシートの側面部分に、他層より後退した凹部を備えた層を配置して積層圧着し端子電極を形成する。また、内層配線電極を平面の端子に接続するビアにおいて、平面端子電極が形成される上下層において、少なくとも1層以上のビア径が他の内層ビア径よりも大きく形成する。



# 【特許請求の範囲】

【請求項1】 回路要素が形成された絶縁性未焼成シートを積層し圧着して、層間をビアで接続して前記回路要素と絶縁性未焼成シートを一体焼成してなる積層電子部品において、側面の端子に接続される内層配線電極に隣接する少なくとも1層の絶縁層が凹部を備えた積層体の側面に形成されたことを特徴とする積層電子部品の端子電極。

【請求項2】 回路要素が形成された絶縁性未焼成シートを積層し圧着して、層間をビアで接続して前記回路要素と絶縁性未焼成シートを一体焼成してなる積層電子部品の内層配線電極を平面の端子に接続するビアにおいて、少なくとも底部の1層以上のビアが、上部の内層よりも大きいビア上に形成されたことを特徴とする積層電子部品の端子電極。

## 【発明の詳細な説明】

### 【0001】

【発明が属する技術分野】本発明は、回路要素が形成された絶縁性未焼成シートを積層し圧着して層間を内部ビアで接続し、側面に端子を塗布接続し一体焼成してなる積層電子部品の端子電極に関するものである。

### 【0002】

【従来の技術】電子機器の小型化、薄型化の要求のため、図2の斜視図および図3の断面図に示すようにコンデンサ、インダクタ、あるいは抵抗などの受動部品とそれらを接続する配線を層間に内蔵し、上面に半導体などの個別部品を搭載した複合部品などの積層電子部品が多用され、表面実装するための端子強度、耐はんだ食われ性などが重要視されている。

【0003】従来の積層電子部品は、絶縁性のグリーンシートに部品を多数個ならべた配置の、各層の所定の箇所にビア接続用の貫通穴を打ち抜き、各層に対応した配線電極を印刷し積層圧着してから、縦横のいずれか1方向に短冊状に切断した2側面に、あるいは両方向に切断した個片の4側面に端子電極を塗布して内層電極の端部に接続していた。その端子電極は、図4の端子部断面図のように回路要素へ接続する層間電極10を部品側面に露出させ、部品側面に端子電極11を塗布し接続させた後、一体焼成して積層電子部品を形成していた。また平面に端子電極を形成するものは、図5の端子部の断面図に示すように、内層電極10から各層の貫通穴に導体ペーストを充填した同一径のビア13で、平面から側面にかけて形成される端子電極11に接続していた。

【0004】しかしながら、厚さ：100 $\mu$ m前後のグリーンシートに厚さ：10 $\mu$ m前後の導体ペーストが印刷形成された、複数のシートを積層圧着した後の切断後の側面となる切断面において、端子に接続される内層配線電極の切断面は、上下の絶縁層に埋ってしまい側面の端子電極形成時に接続しない断線状態の不良になり易く、また側面を研磨して前記の内層配線電極の切断面を

側面に露出させた物でも、950℃前後での一体焼成時に内層電極が内部方向に収縮して、端子電極と断線するものがあつた。

【0005】また、平面に端子電極を形成し内層電極と、貫通穴に導体ペーストを埋め込んだビアで接続する場合も、前記した側面へ端子電極を形成する場合と同様に、950℃前後での一体焼成時にビアを形成する貫通穴に充填された導体ペーストが内部方向に収縮して、端子電極と断線するものがあつた。また平面の端子電極に接続するビアは、内層においては回路配線が張り巡らされているため平面端子に接続するビア径は小さいことが望ましく、このことが残留インダクタンスを大きくしたり、平面端子電極との接続する断面積を小さくしていた。

【0006】また、携帯電話や無線機器などに用いる積層電子部品は、積層厚みが増加する場合や、配線引き回しの長さが長くなると、端子に寄生する残留インダクタンスが無視できず、特に接地端子の残留インダクタンスがGHz以上の高周波帯の特性を劣化させる原因となっていた。

### 【0007】

【発明が解決しようとする課題】本発明は、従来の積層電子部品の製造工程における切断後の側面研磨工程をなくし、また側面あるいは平面の端子電極と内層電極との断線の発生し難い端子電極を提供し、さらに端子電極の残留インダクタンスを減少させてGHz以上の高周波帯での特性を改善することである。

### 【0008】

【課題を解決するための手段】回路要素が形成された絶縁性未焼成シートを積層し圧着して、層間をビアで接続して前記回路要素と絶縁性未焼成シートを一体焼成してなる積層電子部品において、側面の端子に接続される内層配線電極に隣接する少なくとも1層の絶縁層が凹部を備えた積層体の側面に形成されたことを特徴とする積層電子部品の端子電極である。

【0009】厚さ：100 $\mu$ m前後のグリーンシートに厚さ：10 $\mu$ m前後の導体ペーストが印刷形成された、複数のシートを積層圧着した後の切断後の側面となる切断面において、端子に接続される内層配線電極に当接するグリーンシートは、図1の端子部断面図に示すように側面に凹部12が形成され、該凹部に端子電極11が塗布接続されるので、従来は端子配線10の断面接続のみであったものが前記凹部に端子電極11を形成する導体ペーストが塗布埋設されて面接続することになり、接続が確実なものとなる。

【0010】したがって、従来の端子電極形成の前処理工程である側面研磨工程が省略できる。さらに、端子電極塗布後の一体焼成時に内層電極が内部方向に収縮しても、前記の凹部から導体ペーストが補給されるので、内層電極と端子電極が断線することはなく、凹部の形状

は矩形でも半円でもよく、形状には拘らない。

【0011】また、本発明は、回路要素が形成された絶縁性未焼成シートを積層し圧着して、層間をビアで接続して前記回路要素と絶縁性未焼成シートを一体焼成してなる積層電子部品の内層配線電極を平面の端子に接続するビアにおいて、少なくとも底部の1層以上のビアが、上部の内層よりも大きいビア上に形成されたことを特徴とする積層電子部品の端子電極である。

【0012】図6の端子部断面図に示すように、平面の端子に接続する貫通穴において、少なくとも底部の1層以上の貫通穴14が上部の内層の貫通穴13よりも大きくすることにより、内層のビア径はそのままに、平面端子電極11との接続断面積を大きくし接続を確実にすることができる。ビアの形状は円柱でも角柱でもよく、また円柱状あるいは角柱状などのビアを組み合わせて接続したものでもよい。

【0013】

【発明の実施の形態】回路要素が形成された絶縁性未焼成シートの積層に際し、側面の端子に接続される内層配線電極に隣接する少なくとも1層の絶縁層の端部に凹部を備えた層を配置して積層圧着し、前記凹部を含む側面に端子電極を形成する。

【0014】また、回路要素が形成された絶縁性未焼成シートの積層に際し、層間をビアで接続して内層配線電極を底平面の端子に接続するビアの少なくとも底部の1層以上のビア径を、他層のビア径よりも大きい層を配置して積層圧着し、前記ビアを含む底平面に端子電極を形成する。

【0015】

【実施例1】図3の断面図の側面に露出される内層配線電極層に、厚み；100 $\mu$ mのガラス、セラミックのグリーンシートに、内層ビアを形成する $\Phi$ ：0.2mmの貫通穴（図示せず）の打ち抜きと同時に、図7のように個片に切断する予定線上に他の内層ビアと同径の貫通穴10を打ち抜いた。つぎに、内層配線電極10と共に端子接続部13を印刷し、積層圧着しY軸方向の短冊に切断してから両側面に複数の端子電極を塗布し、X軸方向に切断した個片を950℃で一体焼成して積層電子部品を形成した。

【0016】

【実施例2】図8に示す入出力端子1、2とアース端子3を備える積層電子部品を形成するべく実施例1と同様に、積層説明図に示すように内層入出力端子部4、6と内層アース端子部5を2重に備えた層を積層した。

【0017】

【実施例3】実施例1と同様に、 $\Phi$ ：0.2mmの内層ビアと上下層に $\Phi$ ：0.4mmのビアを形成した層と側面の端子に接続する層を、図9の断面図に示すように積層し、断面がコの字の端子電極を形成した。

【0018】

【発明の効果】本発明の端子電極は、従来の積層電子部品の製造工程における切断後の側面研磨工程の必要性がなくなり、側面あるいは平面の端子電極と内層電極との断線の発生がなくなり、さらに端子電極の残留インダクタンスを減少して、GHz以上の高周波帯での特性を改善することができる。

【図面の簡単な説明】

【図1】本発明の側面の端子電極への接続断面図を示す。

【図2】積層電子部品の例を示す。

【図3】積層電子部品の断面図例を示す。

【図4】従来の積層電子部品および側面接続の端子部断面図例を示す。

【図5】従来の積層電子部品および平面端子部の断面図例を示す。

【図6】本発明の平面端子部の断面図例を示す。

【図7】実施例1の内層端子電極の説明図を示す。

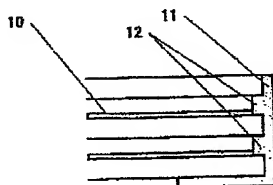
【図8】実施例2の内層端子電極の説明図を示す。

【図9】実施例3の断面図を示す。

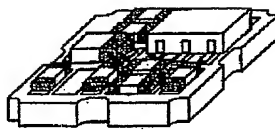
【符号の説明】

- |       |                                    |
|-------|------------------------------------|
| 1、2、3 | 実施例2における側面端子電極                     |
| 4、5、6 | 実施例2における側面端子電極1、2、3にそれぞれ接続する内層端子電極 |
| 10    | 内層配線電極                             |
| 11    | 端子電極                               |
| 12    | 側面端子電極へ接続される凹部                     |
| 13    | 内層のビア                              |
| 14    | 平面端子への接続部のビア                       |

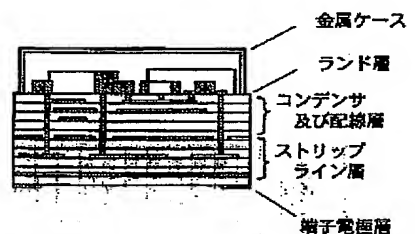
【図1】



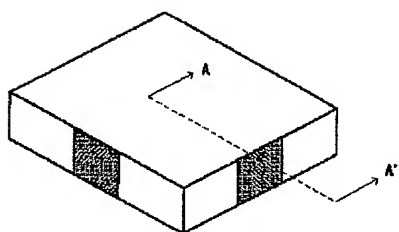
【図2】



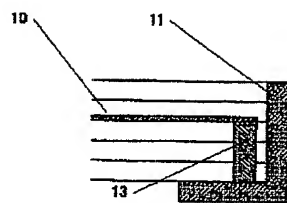
【図3】



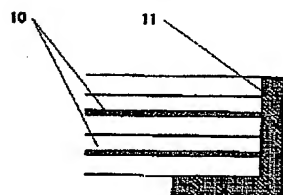
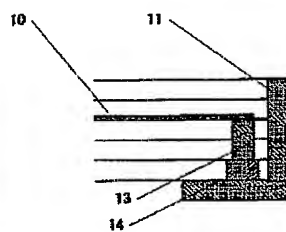
【图4】



【图5】

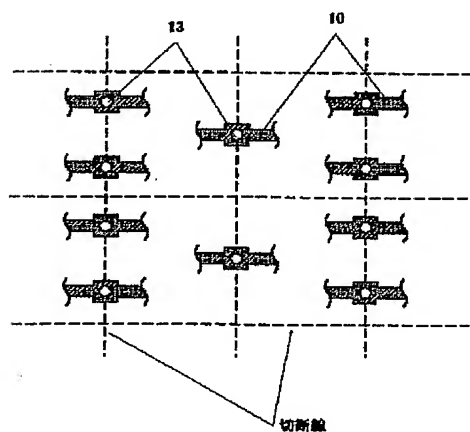


【图6】

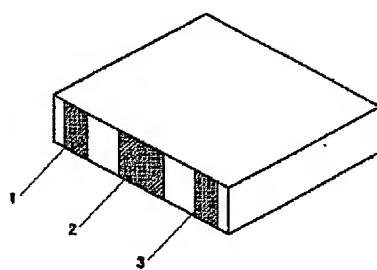


A-A' 断面图

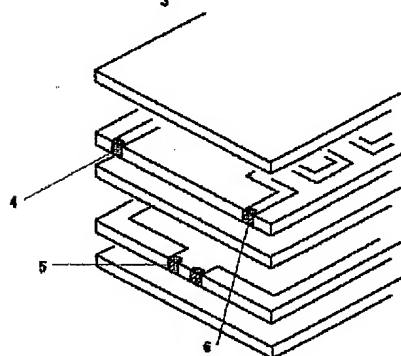
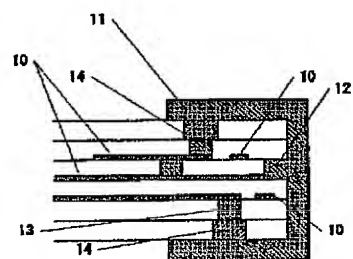
【图7】



【图8】



【图9】



横断面图

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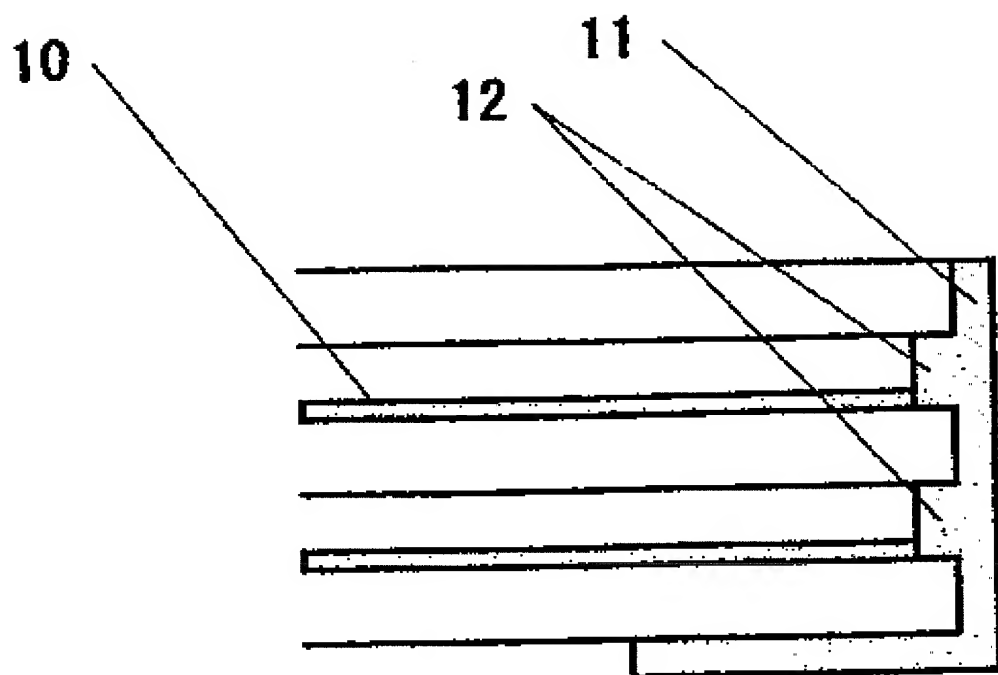
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**CLAIMS****[Claim(s)]**

[Claim 1] The terminal electrode of the laminating electronic parts characterized by to be formed in the side face of a layered product in\_ which the insulating layer of at least one layer which adjoins the inner layer wiring electrode which carries out the laminating of the sheet with which the circuit element was formed non-calcinated [ insulating ], sticks it by pressure, connects between layers from beer, and is connected to the terminal of a side face in the laminating electronic parts which really come to calcinate said circuit element and the sheet non-calcinated [ insulating ] was equipped with the crevice.

[Claim 2] The terminal electrode of the laminating electronic parts characterized by to form the beer of one or more layers of a pars basilaris ossis occipitalis on larger beer than a upside inner layer at least in the beer which carries out the laminating of the sheet with which the circuit element was formed non-calcinated [ insulating ], sticks it by pressure, connects between layers from beer, and connects to a plane terminal the inner layer wiring electrode of the laminating electronic parts which really come to calcinate said circuit element and the sheet non-calcinated [ insulating ].

[Translation done.]



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention carries out the laminating of the sheet with which the circuit element was formed non-calcinated [ insulating ], sticks it by pressure, connects between layers from internal beer, makes spreading connection of the terminal on a side face, and relates to the terminal electrode of the laminating electronic parts which it really comes to calcinate.

[0002]

[Description of the Prior Art] For the demand of the miniaturization of electronic equipment, and thin-shape-izing, as shown in the perspective view of drawing 2 , and the sectional view of drawing 3 , wiring which connects them with passive components, such as a capacitor, an inductor, or resistance, is built in between layers, and laminating electronic parts, such as composite part which carried discrete part, such as a semi-conductor, in the top face, are used abundantly, and importance is attached to the terminal reinforcement for carrying out a surface mount, solder-proof foods crack nature, etc.

[0003] The conventional laminating electronic parts pierced the through hole for beer connection in the predetermined part of each class of the arrangement which was able to be located in a line with the insulating green sheet in many components, after they printed the wiring electrode corresponding to each class and carried out laminating sticking by pressure, applied the terminal electrode to four side faces of the piece of an individual cut in two side faces cut in the shape of a strip of paper in the any 1 direction in every direction, or both directions, and had connected it to the edge of a inner layer electrode. The terminal electrode exposed the electrode 10 between layers connected to a circuit element as shown in the terminal area sectional view of drawing 4 on the components side face, after applying and connecting the terminal electrode 11 to a components side face, was really calcinated and formed laminating electronic parts. Moreover, what forms a terminal electrode in a flat surface was connected to the terminal electrode 11 which is beer 13 of the diameter of the same which filled up the through hole of each class with conductive paste from the inner layer electrode 10, and is formed in a side face from a flat surface, covering as shown in the sectional view of the terminal area of drawing 5 .

[0004] However, it sets to the cutting plane which becomes a green sheet around thickness:100 micrometers with the side face after cutting after the conductive paste around thickness:10 micrometers carries out laminating sticking by pressure of two or more sheets by which printing formation was carried out. The cutting plane of the inner layer wiring electrode connected to a terminal tends to become the defect of an open-circuit condition who is buried with an up-and-down insulating layer, and does not connect at the time of terminal electrode formation of a side face. Moreover, the inner layer electrode contracted in the direction of the interior at the time of one baking around 950 degrees C, and the object which the side face was ground [ object ] and exposed the cutting plane of the aforementioned inner layer wiring electrode on the side face also had a terminal electrode and the thing to disconnect.

[0005] Moreover, the terminal electrode was formed in the flat surface, the conductive paste with which the through hole which forms beer at the time of one baking around 950 degrees C like the case where a terminal electrode is formed in the above mentioned side face also when connecting with a inner layer electrode from the beer which embedded conductive paste at the through hole was filled up contracted in the direction of the interior, and there were a terminal electrode and a thing to disconnect. Moreover, the small thing of the diameter of beer which connects the beer linked to a plane terminal electrode to a flat-surface terminal since circuit wiring is spread around in the inner layer was desirable, and this enlarged residual inductance and made small the cross section with a flat-surface terminal electrode to connect.



[0006] Moreover, the laminating electronic parts used for a cellular phone, a wireless device, etc. had become the cause by which the residual inductance which is parasitic on a terminal could not be disregarded, especially the residual inductance of an earth terminal degraded the property of the RF band more than GHz, when the case where laminating thickness increases, and the die length of wiring leading about became long.

[0007]

[Problem(s) to be Solved by the Invention] This invention is offering the terminal electrode which abolishes the side-face polish process after cutting in the production process of the conventional laminating electronic parts, and an open circuit with the terminal electrode's of a side face's or a flat surface and a inner layer electrode cannot generate easily, decreasing the residual inductance of a terminal electrode further, and improving the property in the RF band more than GHz.

[0008]

[Means for Solving the Problem] The insulating layer of at least one layer which adjoins the inner layer wiring electrode which carries out the laminating of the sheet with which the circuit element was formed non-calcinated [ insulating ], sticks it by pressure, connects between layers from beer, and is connected to the terminal of a side face in the laminating electronic parts which really come to calcinate said circuit element and the sheet non-calcinated [ insulating ] is the terminal electrode of the laminating electronic parts characterized by to be formed in the side face of the layered product equipped with the crevice.

[0009] Thickness : In the cutting plane which becomes a green sheet around 100 micrometers with the side face after cutting after carrying out laminating sticking by pressure of two or more sheets with which printing formation of the conductive paste around :10 micrometers was carried out in thickness The green sheet which contacts the inner layer wiring electrode connected to a terminal Since a crevice 12 is formed in a side face as shown in the terminal area sectional view of drawing 1 , and spreading connection of the terminal electrode 11 is made in this crevice Conventionally, spreading laying under the ground of the conductive paste with which what was only cross-section connection of the terminal wiring 10 forms the terminal electrode 11 in said crevice is carried out, field connection will be made and connection becomes a positive thing.

[0010] Therefore, the side-face polish process which is a head end process of the conventional terminal electrode formation can be skipped. Furthermore, even if a inner layer electrode contracts in the direction of the interior at the time of one baking after terminal electrode spreading, since conductive paste is supplied from the aforementioned crevice, a inner layer electrode and a terminal electrode are not disconnected, a rectangle or a semicircle is sufficient as the configuration of a crevice, and it does not adhere to a configuration.

[0011] Moreover, this invention is the terminal electrode of the laminating electronic parts characterized by to form the beer of one or more layers of a pars basilaris ossis occipitalis on larger beer than a upside inner layer at least in the beer which carries out the laminating of the sheet with which the circuit element was formed non-calcinated [ insulating ], sticks it by pressure, connects between layers from beer, and connects to a plane terminal the inner layer wiring electrode of the laminating electronic parts which really come to calcinate said circuit element and the sheet non-calcinated [ insulating ].

[0012] In the through hole linked to a plane terminal, as shown in the terminal area sectional view of drawing 6 , when the through hole 14 of one or more layers of a pars basilaris ossis occipitalis makes it at least larger than the through hole 13 of a upside inner layer, as it is, the diameter of beer of a inner layer can enlarge connection interrupt area with the flat-surface terminal electrode 11, and can ensure connection. A cylinder or a prism is sufficient as the configuration of beer, and cylindrical or the thing connected combining beer, such as a prismatic form, is sufficient as it.

[0013]

[Embodiment of the Invention] On the occasion of the laminating of the sheet non-calcinated [ insulating ] in which the circuit element was formed, the layer which equipped with the crevice the edge of the insulating layer of at least one layer which adjoins the inner layer wiring electrode connected to the terminal of a side face is arranged, laminating sticking by pressure is carried out, and a terminal electrode is formed in a side face including said crevice.

[0014] Moreover, on the occasion of the laminating of the sheet non-calcinated [ insulating ] in which the circuit element was formed, at least, a larger layer than the diameter of beer of other layers is arranged, laminating sticking by pressure of the diameter of beer of one or more layers of a pars basilaris ossis occipitalis is carried out, and a terminal electrode is formed in the bottom plane containing said beer of the beer which connects between layers from beer and connects a inner layer wiring electrode to the terminal of a bottom plane.

[0015]

[Example 1] Other inner layer beer and the through hole 10 of the diameter of said were pierced on the projected line which the  $\phi$ :0.2mm through hole (not shown) which forms inner layer beer in thickness;100micrometer glass and the green sheet of a ceramic pierces in the inner layer wiring electrode layer exposed to the side face of the sectional view of drawing 3 , simultaneously is cut like drawing 7 in it at the piece of an individual. After printing the terminal strapping section 13, carrying out laminating sticking by pressure with the inner layer wiring electrode 10 and cutting to the strip of paper of Y shaft orientations next, two or more terminal electrodes were applied to the both-sides side, the piece of an individual cut to X shaft orientations was really calcinated at 950 degrees C, and laminating electronic parts were formed.

[0016]

[Example 2] The laminating of the layer which equipped the duplex with the inner layer input/output terminal sections 4 and 6 and the inner layer grounding terminal section 5 like the example 1 as shown in a laminating explanatory view was carried out in order to form laminating electronic parts equipped with the input/output terminals 1 and 2 shown in drawing 8 , and a grounding terminal 3.

[0017]

[Example 3] Like the example 1, as shown in the sectional view of drawing 9 , the laminating of  $\phi$ :0.2mm inner layer beer, the layer which formed  $\phi$ :0.4mm beer in the vertical layer, and the layer linked to the terminal of a side face was carried out, and the cross section formed the terminal electrode of the character of KO.

[0018]

[Effect of the Invention] The need for the side-face polish process after cutting in the production process of the conventional laminating electronic parts of the terminal electrode of this invention can be lost, and generating of an open circuit with the terminal electrode of a side face or a flat surface and a inner layer electrode of it can be lost, they can decrease in number the residual inductance of a terminal electrode further, and can improve the property in the RF band more than GHz.

[Translation done.]

**\* NOTICES \***

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**DESCRIPTION OF DRAWINGS**

**[Brief Description of the Drawings]**

- [Drawing 1]** The connection interrupt side Fig. to the terminal electrode of the side face of this invention is shown.
- [Drawing 2]** The example of laminating electronic parts is shown.
- [Drawing 3]** The example of a sectional view of laminating electronic parts is shown.
- [Drawing 4]** The conventional laminating electronic parts and the example of a terminal area sectional view of side-face connection are shown.
- [Drawing 5]** The conventional laminating electronic parts and the example of a sectional view of a flat-surface terminal area are shown.
- [Drawing 6]** The example of a sectional view of the flat-surface terminal area of this invention is shown.
- [Drawing 7]** The explanatory view of the inner layer terminal electrode of an example 1 is shown.
- [Drawing 8]** The explanatory view of the inner layer terminal electrode of an example 2 is shown.
- [Drawing 9]** The sectional view of an example 3 is shown.

**[Description of Notations]**

- 1, 2, 3 Side-face terminal electrode in an example 2
- 4, 5, 6 Inner layer terminal electrode connected to the side-face terminal electrodes 1, 2, and 3 in an example 2, respectively
- 10 Inner Layer Wiring Electrode
- 11 Terminal Electrode
- 12 Crevice Connected to Side-Face Terminal Electrode
- 13 Beer of Inner Layer
- 14 Beer of Connection to Flat-Surface Terminal

**[Translation done.]**

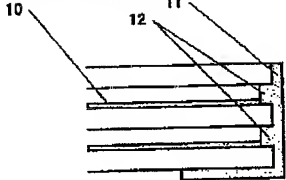
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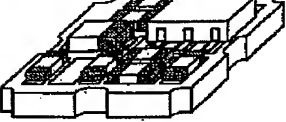
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DRAWINGS

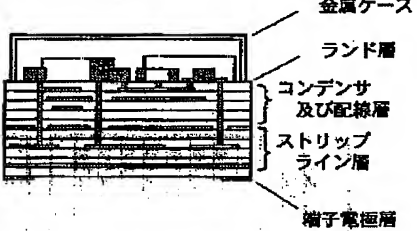
[Drawing 1]



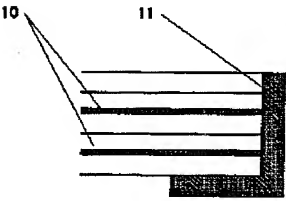
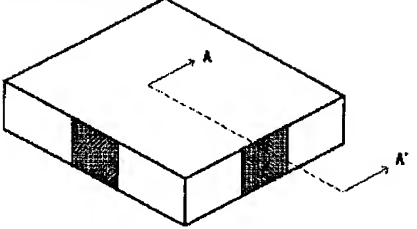
[Drawing 2]



[Drawing 3]

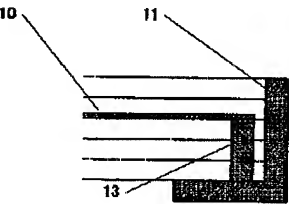


[Drawing 4]

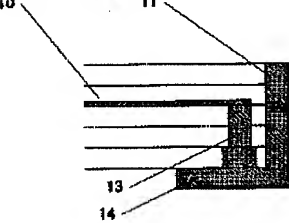


A-A' 断面図

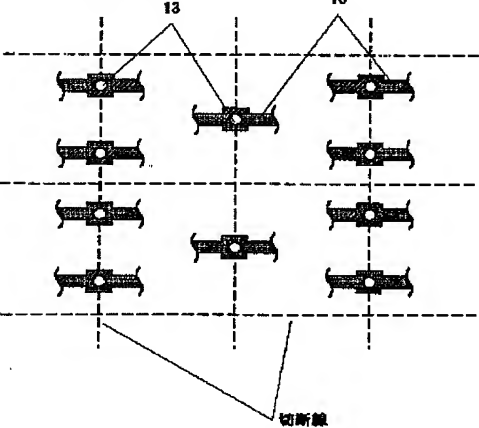
[Drawing 5]



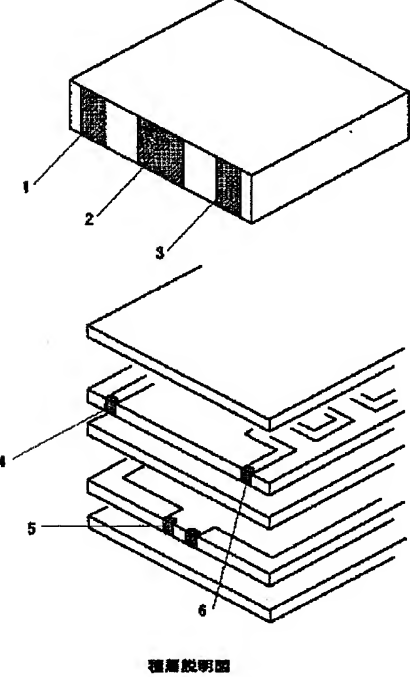
[Drawing 6]



[Drawing 7]



[Drawing 8]



[Translation done.]